REMARKS/ARGUMENTS

Summary of the Office Action:

(1) rejected claims 19 and 67-83 under 35 U.S.C. 103(a) as being unpatentable over Collins et al. (U.S. Patent 5,556,501) in view of DeOrnellas et al. (WO99/25568);

(2) rejected claims 19 and 67-83 under 35 U.S.C. 103(a) as being unpatentable over Collins et al. (U.S. Patent 5,556,501) in view of Keizo (JP07-130712A);

(3) rejected claims 19, 67, 69-70, 72-78, and 80-83 under 35 U.S.C. 103(a) as being unpatentable over Imai et al. (WO97/27622) in view of DeOrnellas et al. (WO99/25568);

(4) rejected claims 68, 71, and 79 under 35 U.S.C. 103(a) as being unpatentable over Imai et al. (WO97/27622) in view of DeOrnellas et al. (WO99/25568) as applied to claims 19, 67, 69-70, 72-78, and 80-83 above, and further in view of Collins et al. (U.S. Patent 5,556,501);

(5) rejected claims 19, 67, 69-70, 72-78, and 80-83 under 35 U.S.C. 103(a) as being unpatentable over Imai et al. (WO97/27622) in view of Keizo (JP07-130712A);

(6) rejected claims 68, 71, and 79 under 35 U.S.C. 103(a) as being unpatentable over Imai et al. (WO97/27622) in view of Keizo (JP07-130712A) as applied to claims 19, 67, 69-70, 72-78, and 80-83 above, and further in view of Collins et al. (U.S. Patent 5,556,501).

Claims 19 and 67-83 are currently pending. The present Reply amends claim 69, cancels claims 76-83, and adds claims 84-86, leaving for the Examiner's present consideration claims 19, 67-75, and 84-86. Reconsideration of the rejections is requested.

Arguments:

(1) Claims 19 and 67-83 stand rejected under 35 U.S.C. 103(a) as being unpatentable over *Collins* et al. (U.S. Patent 5,556,501) in view of *DeOrnellas* et al. (WO99/25568). Applicants request cancellation of claims 76-83 for pursuit in a continuation application. Applicants respectfully traverse the rejection the rejection of claims 19 and 67-75.

Applicants note that the claims at issue are method claims and not system claims; therefore, the capability of a process chamber to perform the method does not render the claims obvious. The references, singly or in combination, must teach the recited steps of the claims.

Claims 19, 67 and 68

Nowhere does *Collins* in view of *DeOrnellas* disclose "heating the upper electrode with said heater to a temperature in order to cause deposits of oxygen and chlorine to de-absorb from the upper electrode in order to leave mostly platinum deposited on the electrode, such that a layer of material is formed on the upper electrode; wherein the layer of material formed on the upper electrode is more stable than a layer of material formed when heating the upper electrode with said heater to a temperature insufficient to cause deposits of oxygen and chlorine to de-absorb from the upper electrode" as recited in claim 19.

The Examiner writes that "heating the upper electrode with said first heater to a temperature such that any material resulting from the reaction deposited on the surface of the upper electrode forms a stable film comprising halogen elements (see fig. 1 and its description)." See OA, page 3. *Collins* in view of *DeOrnellas* **does not** show such a result. Further, the language recited differs from claim 19, and *Collins* in view of *DeOrnellas* fails to anticipate the limitation of claim 19 recited above. The only recitation in *Collins* or *DeOrnellas* of a stable film is in the reactivity of silicon of the upper electrode with a fluorine-based chemistry to affect the process characteristics:

> "In addition, the free silicon affects the polymerization reaction and results in a more stable passivating polymer deposition on the silicon, preferentially relative to the oxide, with enhanced suppression of the polysilicon etch rate and increased oxide selectivity relative to the silicon.
>
> In addition, the sacrificial silicon-containing third electrode operates synergistically with the use of a carbon- and oxygen-containing gas such as CO and/or CO_2 additive, to form polymers on polysilicon surfaces. This increases suppression of silicon etching and enhances selectivity for oxide relative to

> silicon and increases the polymer sidewall deposition on the oxide, thus enhancing etch anisotropy and vertical sidewall etch profile of the oxide."

See *Collins*, col. 22, lines 21-34.

Collins explicitly states that "the free silicon affects the **polymerization reaction** and results in a more stable passivating polymer" (emphasis added). *Collins* is directed to the reaction of the free silicon with the fluorine and does not teach reaction of deposited polymer with the upper electrode. Polymerization is a chemical reaction in which two or more small molecules **combine** to form larger molecules. In contrast, to de-absorb, a molecule breaks up to form simpler molecules.

Collins is not clear whether heating the upper electrode provides any function other than stimulating reaction of the free silicon with the fluorine. The only clue provided is in element g) of claim 1 of *Collins*, which recites:

> a second electrode disposed above said cathode electrode and comprising silicon for chemically interacting with components of said processing gas; **wherein said second electrode is controllably heated to increase its reactivity**.

(Emphasis added). *Collins* in view of *DeOrnellas* discloses that increasing reactivity of the silicon with the fluorine (by way of heating) results in passivating polymer. *Collins* in view of *DeOrnellas* does not disclose increasing a reaction of the polymer itself with the upper electrode (i.e., heating the upper electrode affects the reactants in *Collins* in view of *DeOrnellas*, while heating the upper electrode affects the products in claim 19). *Collins* in view of *DeOrnellas* does not teach that de-absorption of oxygen or chlorine occurs at any time during the process. In its disclosure *Collins* in view of *DeOrnellas* is more explicit regarding the operating conditions for achieving this increase in reactivity of the free silicon electrode with fluorine, stating:

> The chamber walls and the dome can be heated and/or cooled by air convection (blown air) and/or a dielectric fluid heat exchanger. For example, closed circuit heat exchanger 92 recirculates dielectric fluid at a controlled temperature ranging from heating to cooling, for example, **+120 °C** to -150 °C, along path 93 through the chamber sidewalls. **Similarly, the dome sidewalls 17W and top 17T can be heated and/or cooled by heat exchangers** 94 and 96 which recirculate fluid along paths 95 and 97, respectively.

(Emphasis added). See *Collins* col. 21, lines 15-24. However, such process parameters are far lower than those required to achieve the method of claim 19. The text of the present application generally describes the preferred operating temperature to achieve de-absorption, disclosing that:

> **[0024]** In a preferred embodiment, where the electrode is made out of aluminum, the upper electrode (and/or the electrode opposite to the electrode or chuck holding a wafer to be processed) is preferably heated to a maximum temperature of about 300 to about 350 degrees C. With the upper electrode made of graphite or silicon, the maximum temperature is preferably about 400 to about 500 degrees C.
>
> **[0025]** Without being so heated, in a typical etch reactor, the upper electrode would be floating at a maximum temperature of about 100 degrees C.
>
> ...
>
> **[0029]** The graph of **FIG. 6** demonstrates that as the temperature of the surface is increased, the deposit thickness greatly decreases along with the content of halogens (for halogen gas system) in the deposited material. With a decrease in halogen compounds (such as $PtCl_x$), the deposited materials are thinner and more adherent and tend toward a simple material such as platinum.

As listed in available chemistry references, platinum (II) chloride ($PtCl_2$) has a melting temperature (a temperature at which it decomposes) of 581°C (at 1 atm) and platinum (IV) chloride ($PtCl_4$) has a melting temperature of 370°C (at 1 atm). Platinum dioxide (PtO_2) has a melting temperature of 450°C (at 1 atm). The decomposition of these compounds is relatively insensitive to pressure.

The Examiner writes that "one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references.... DeOrnellas et al. is not being relied upon to show heating of the upper electrode." See OA, page 12. The references in combination must teach all of the limitations of the claim, either explicitly or inherently. Applicants respectfully disagree that the combination of *Collins* and *DeOrnellas* has, or can be shown to teach all of the limitations of claim 19, explicitly or inherently. There is a deficiency in the combination of *Collins* and *DeOrnellas*. As described above, *Collins* teaches increasing reactivity of the upper electrode by increasing the temperature of the upper electrode (exemplary temperature to achieve an increase in reactivity given as, at a maximum, +120°C). Combining

Collins with *DeOrnellas*, if such a combination could be achieved, would teach increasing the temperature of the upper electrode of *Collins* using a platinum etch of *DeOrnellas* ("where platinum or other materials are etched in a chlorine gas and oxygen is inherently present" see OA, page 7) to a maximum of +120°C. But to what effect? The combination teaches raising the temperature of the upper electrode to about +120°C to induce higher reactivity of the free silicon of the upper electrode. The combination does not teach raising the temperature of the upper electrode to about +120°C to cause chlorine and oxygen to de-absorb from the upper electrode to produce a more stable film. *Collins* is silent on the effect of upper electrode temperature on the polymer itself, discussing only the effect of upper electrode temperature on the reactants (which is irrelevant to *DeOrnellas* because *DeOrnellas* does not use free silicon to scavenge fluorine). The results on the polymer deposited on the upper electrode heated beyond +120°C cannot be extrapolated based on *Collins*, nor is it evident that there is any result on the polymer at +120°C. Decomposition of platinum chloride occurs at temperatures much higher than +120°C (at 1 atm, $PtCl_4$ decomposition occurs at temperatures approaching +370 °C).

Regarding the inherency of "heating…in order to cause deposits of oxygen and chlorine to de-absorb from the upper electrode…such that a layer of material is formed on the upper electrode; wherein the layer of material formed on the upper electrode is more stable" as recited in claim 19, it is not clear that **any** de-absorption of oxygen and chlorine from the upper electrode occurs at +120°C. The Examiner writes that "note that inherently any gas collected on the upper surface will desorb or boil off from the surface as a result of heating of these surfaces." See OA, page 4. However, claim 19 does not only recite de-absorbing chlorine and oxygen, but doing so "in order to leave mostly platinum deposited on the electrode, such that a layer of material is formed on the upper electrode; wherein the layer of material formed on the upper electrode is more stable than a layer of material formed when heating the upper electrode with said heater to a temperature insufficient to cause deposits of oxygen and chlorine to de-absorb from the upper electrode." This limitation is not explicitly taught by the cited references and is not inherent to the cited references. Applicants dispute that it is obvious that heating the upper electrode will increase stability of a deposited polymer, per se. One of ordinary skill in the art will appreciate that plasma physics does not provide linear or easily extrapolated results.

Because *Collins* in view of *DeOrnellas* fails to teach or suggest all of the limitations of claim 19, *Collins* in view of *DeOrnellas* cannot render claim 19 obvious under 35 U.S.C. 103(a). Dependent claims include at least the features of the independent claim from which they depend. Therefore, *Collins* in view of *DeOrnellas* cannot render claims 67 and 68 (which depend from claim 19) obvious under 35 U.S.C. 103(a).

Claims 69-75

Nowhere does *Collins* in view of *DeOrnellas* disclose "heating the upper electrode with said heater to a temperature in order to cause halogen elements to de-absorb from the upper electrode such that deposits of mostly platinum forms a layer of material; wherein the layer of material formed on the upper electrode is more stable than a layer of material formed when heating the upper electrode with said heater to a temperature insufficient to cause deposits of mostly platinum on the surface of the upper electrode" as recited in claim 69.

For the same reasons given above in regards to claim 19, *Collins* in view of *DeOrnellas* fails to disclose all of the limitations of claim 69. Because *Collins* in view of *DeOrnellas* fails to teach or suggest all of the limitations of claim 69, *Collins* in view of *DeOrnellas* cannot render claim 69 obvious under 35 U.S.C. 103(a). Dependent claims include at least the features of the independent claim from which they depend. Therefore, *Collins* in view of *DeOrnellas* cannot render claims 70-75 (which depend from claim 69) obvious under 35 U.S.C. 103(a).

(2) Claims 19 and 67-83 stand rejected under 35 U.S.C. 103(a) as being unpatentable over *Collins* in view of *Keizo* (JP07-130712A), Applicants respectfully traverse the rejection of claims 19 and 67-75.

The Examiner writes that *Keizo* is presented for disclosing "performing plasma etching of platinum using a chloride containing gas (see abstract). Furthermore, note that inherently oxygen will be present in the chamber." See OA, page 5. *Keizo* adds nothing over the combination of *Collins* in view of *DeOrnellas*, and thus fails for the same reason to remedy the deficiency of *Collins*.

Thus, for the reasons give in (1) above, *Collins* in view of *Keizo* fails to recite all of the features of claims 19 and 67-83. Therefore, *Collins* in view of *Keizo* cannot render claims 19 and 67-83 obvious under 103(a).

(3) Claims 19, 67, 69-70, 72-78 and 80-83 stand rejected under 35 U.S.C. 103(a) as being unpatentable over *Imai* (WO 97/27622) in view of *DeOrnellas*, Applicants respectfully traverse the rejection of claims 19 , 67, 69-70 and 72-75.

Applicants reiterate that the claims at issue are method claims and not system claims; therefore, the capability of a process chamber to perform the method does not render the claims obvious. The references, singly or in combination must teach the recited steps of the claim.

The Examiner writes that "Imai et al. shows...heating the upper electrode with said heater 11 to a temperature such that any material resulting from the reaction deposited on the surface of the upper electrode forms a stable film comprising halogen elements (see fig. 1 and

abstract)." See OA, page 7. However, *Imai* does not teach this at all. *Imai* teaches conditioning consumable components (an upper silicon electrode and silicon ring) to produce a generally stable selectivity and etch rate. As is known in the art, aging of consumable components within a chamber can cause variation in etch rate and selectivity. *Imai* teaches a method of controlling the average roughness of irregularities of the halogen scavengers (the ring and electrode).

Referring to the English language U.S. Pat. No. 6,214,740 (which corresponds to the cited WO 97/27622 reference) only once is the temperature of the upper electrode mentioned: "Numeral 11 is a heater, which maintains the upper silicon electrode 5 at a constant temperature." See col. 1, lines 39-42. Again, as argued above in (1), it is not clear that **any** de-absorption of oxygen and chlorine from the polymer occurs in the process of *Imai*. Merely heating the upper electrode does not teach de-absorption of oxygen and chlorine from the polymer. As argued above, *DeOrnellas* fails to teach these limitations. Nowhere does *Imai* teach or suggest "heating the upper electrode with said heater to a temperature in order to cause deposits of oxygen and chlorine to de-absorb from the upper electrode in order to leave mostly platinum deposited on the electrode, such that a layer of material is formed on the upper electrode; wherein the layer of material formed on the upper electrode is more stable than a layer of material formed when heating the upper electrode with said heater to a temperature insufficient to cause deposits of oxygen and chlorine to de-absorb from the upper electrode" as recited in claim 19 or "heating the upper electrode with said heater to a temperature in order to cause halogen elements to de-absorb from the upper electrode such that deposits of mostly platinum forms a layer of material; wherein the layer of material formed on the upper electrode is more stable than a layer of material formed when heating the upper electrode with said heater to a temperature insufficient to cause deposits of mostly platinum on the surface of the upper electrode" as recited in claim 69.

Because *Imai* in view of *DeOrnellas* fails to teach or suggest all of the limitations of claims 19 and 69, *Imai* in view of *DeOrnellas* cannot render claims 19 and 69 obvious under 35 U.S.C. 103(a). Dependent claims include at least the features of the independent claim from which they depend. Therefore, *Imai* in view of *DeOrnellas* cannot render claims 67 (which depends from claim 19) and claims 70 and 72-75 (which depend from claim 69) obvious under 35 U.S.C. 103(a).

(4) Claims 68, 71 and 79 stand rejected under 35 U.S.C. 103(a) as being unpatentable over *Imai* in view of *DeOrnellas* in further view of *Collins*. Applicants respectfully traverse the rejection.

As argued in (1) above, *Collins* in view of *DeOrnellas* fails to recite all of the limitations of claims 19 and 69. As demonstrated in (3), *Imai* in view of *DeOrnellas* is even more deficient

than *Collins* in view of *DeOrnellas*. Likewise, *Imai* in view of *DeOrnellas* in further view of *Collins* again fails to teach or suggest "heating the upper electrode with said heater to a temperature in order to cause deposits of oxygen and chlorine to de-absorb from the upper electrode in order to leave mostly platinum deposited on the electrode, such that a layer of material is formed on the upper electrode; wherein the layer of material formed on the upper electrode is more stable than a layer of material formed when heating the upper electrode with said heater to a temperature insufficient to cause deposits of oxygen and chlorine to de-absorb from the upper electrode" as recited in claim 19 or "heating the upper electrode with said heater to a temperature in order to cause halogen elements to de-absorb from the upper electrode such that deposits of mostly platinum forms a layer of material; wherein the layer of material formed on the upper electrode is more stable than a layer of material formed when heating the upper electrode with said heater to a temperature insufficient to cause deposits of mostly platinum on the surface of the upper electrode" as recited in claim 69.

Because *Imai* in view of *DeOrnellas* in further view of *Collins* fails to teach or suggest all of the limitations of claims 19 and 69, *Imai* in view of *DeOrnellas* in further view of *Collins* cannot render claims 19 and 69 obvious under 35 U.S.C. 103(a). Dependent claims include at least the features of the independent claim from which they depend. Therefore, *Imai* in view of *DeOrnellas* in further view of *Collins* cannot render claims 68 (which depends from claim 19) and claims 71 and 79 (which depend from claim 69) obvious under 35 U.S.C. 103(a).

(5) Claims 19, 67, 69-70, 72-78, and 80-83 stand rejected under 35 U.S.C. 103(a) as being unpatentable over *Imai* in view of *Keizo*. Applicants respectfully traverse the rejection of claims 19, 67, 69-70 and 72-75.

As indicated above in (3), *Imai* fails to teach or suggest all of the limitations of claim 19 and 69. As similarly noted above in (2), *Keizo* adds nothing over the combination of *Imai* in view of *DeOrnellas*, and thus fails for the same reasons to render claims 19 and 69 obvious.

Because *Imai* in view of *Keizo* fails to teach or suggest all of the limitations of claims 19 and 69, *Imai* in view of *Keizo* cannot render claims 19 and 69 obvious under 35 U.S.C. 103(a). Dependent claims include at least the features of the independent claim from which they depend. Therefore, *Imai* in view of *Keizo* cannot render claims 67 (which depends from claim 19) and claims 70 and 72-75 (which depend from claim 69) obvious under 35 U.S.C. 103(a).

(6) Claims 68, 71, and 79 stand rejected under 35 U.S.C. 103(a) as being unpatentable over *Imai* in view of *Keizo* as applied to claims 19, 67, 69-70, 72-78, and 80-83 above, and further in view of *Collins*. Applicants respectfully traverse the rejection of claims 68 and 71.

As noted above in (1)-(5), neither *Imai*, nor *Keizo*, nor *Collins* teaches or suggests "heating the upper electrode with said heater to a temperature in order to cause deposits of oxygen and chlorine to de-absorb from the upper electrode in order to leave mostly platinum deposited on the electrode, such that a layer of material is formed on the upper electrode; wherein the layer of material formed on the upper electrode is more stable than a layer of material formed when heating the upper electrode with said heater to a temperature insufficient to cause deposits of oxygen and chlorine to de-absorb from the upper electrode" as recited in claim 19 or "heating the upper electrode with said heater to a temperature in order to cause halogen elements to de-absorb from the upper electrode such that deposits of mostly platinum forms a layer of material; wherein the layer of material formed on the upper electrode is more stable than a layer of material formed when heating the upper electrode with said heater to a temperature insufficient to cause deposits of mostly platinum on the surface of the upper electrode" as recited in claim 69.

Taken in combination, *Imai* in view of *Keizo* in further view of *Collins* still fails to teach or suggest "heating the upper electrode with said heater to a temperature in order to cause deposits of oxygen and chlorine to de-absorb from the upper electrode in order to leave mostly platinum deposited on the electrode, such that a layer of material is formed on the upper electrode; wherein the layer of material formed on the upper electrode is more stable than a layer of material formed when heating the upper electrode with said heater to a temperature insufficient to cause deposits of oxygen and chlorine to de-absorb from the upper electrode" as recited in claim 19 or "heating the upper electrode with said heater to a temperature in order to cause halogen elements to de-absorb from the upper electrode such that deposits of mostly platinum forms a layer of material; wherein the layer of material formed on the upper electrode is more stable than a layer of material formed when heating the upper electrode with said heater to a temperature insufficient to cause deposits of mostly platinum on the surface of the upper electrode" as recited in claim 69.

Because *Imai* in view of *Keizo* in further view of *Collins* fails to teach or suggest all of the limitations of claims 19 and 69, *Imai* in view of *Keizo* in further view of *Collins* cannot render claims 19 and 69 obvious under 35 U.S.C. 103(a). Dependent claims include at least the features of the independent claim from which they depend. Therefore, *Imai* in view of *Keizo* in further view of *Collins* cannot render claims 68 (which depends from claim 19) and claims 71 (which depend from claim 69) obvious under 35 U.S.C. 103(a).

Newly Added Claims 84-86:

Applicants submit that newly added claims 84-86 are allowable over the cited prior art.

Conclusion

In light of the above, it is respectfully submitted that all of the claims now pending in the subject patent application should be allowable, and a Notice of Allowance is requested. The Examiner is respectfully requested to telephone the undersigned if he can assist in any way in expediting issuance of a patent.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 06-1325 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

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